Rearing The Greater Wax Moth

U.S. DEPARTMENT OF AGRICULTURE

Science Study Aid No. 3

REARING THE GREATER WAX MOTH IN THE CLASSROOM

This series of activities has been designed primarily to study complete metamorphosis as shown by the life cycle of the greater wax moth. You may use this material as a supplement to a study of complete metamorphosis, insects, or living organisms in general. It should be stimulating to elementary or secondary school students, provided that they have not had extensive experience in rearing insects.

BACKGROUND INFORMATION

The greater wax moth (*Galleria mellonella*) is known under many names in different sections of the United States. Beekeepers know the insect as the wax moth, bee moth, bee miller, wax worm, web worm, and wax miller. The approved common name is the greater wax moth, to distinguish it from an entirely different insect, the lesser wax moth (*Achroia grisella*). The greater wax moth finds conditions most favorable in the Temperate Zone. The high altitudes of the Rocky Mountains are free of this moth, but it can be found almost anywhere else in the United States where there are bees.

OBJECTIVES

By the end of these activities, the child should be able to identify and name the various stages in the life cycle of the greater wax moth; define metamorphosis; and describe each stage in the

Rearing the Greater Wax Moth was developed by Mrs. Brenda Vaughan and Mrs. Marcia Walton, elementary science specialists in the District of Columbia school system. They prepared it while working with scientists at the Agricultural Research Center at Beltsville, Md.

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life cycle, distinguishing color, shape, size, and movement.

The greater wax moth is an excellent insect for study and classroom use. It is hardy, odorless, and easy to rear. Once hatched, it needs no special care, other than temperature control, to complete its life cycle. In addition, it does not transmit disease to humans and can be handled safely by children. Once the culture has been established, no daily maintenance is required. The culture is self-contained, and the insect will develop from egg to adult in the same environment.

The children may examine the culture at anytime, but instruct them to return it to the incubator after observing it. Precautions should be taken not to free the moths since they are harmful to bees and will also tunnel through cloth or other material.

Sources of greater wax moth eggs include the following:

Butterfly Company
291 East 98th Street
Brooklyn, New York 11212

SCH Corporation
1 Greentree Place
Greenbelt, Maryland 20770

NASCO
Fort Atkins, Wisconsin 53538

Tri-State Bait Company
892 E. Chicago Road
Coldwater, Michigan 49036

If you have difficulty locating eggs, contact your State University extension entomologist. You can obtain the materials necessary to establish a culture in your local supermarket or pharmacy.

VOCABULARY

abdomen—the insect's rear section.
antennae—feelers on the insect's head.
chrysalis—the pupa of a butterfly.
cocoon—the silken tent where insects spend their pupal stage.
forceps—a pair of pincers or tongs for delicate operations.
insect—a small animal with 3 distinct body regions, 3 pairs of legs, and no backbone.
incubator—apparatus to help the insect's eggs to hatch.
larva—the wingless, wormlike form of insects after they hatch from eggs.
life cycle—the series of stages in an organism's life.
metamorphosis—a marked and abrupt change in appearance or form.
pupa—the insect's dormant stage, which lasts until the larva transforms to adult.
thorax—the insect's middle section.

DAMAGE AND CONTROL

The greater wax moth is most destructive to honeycombs in storage, especially to those stored in dark, warm, poorly ventilated places. The larvae of the moth tunnel into the combs, leaving them a mass of webs and debris. Sometimes it may attack combs within the active hive if the hive is weak, diseased, starved, or otherwise abnormal.

The most effective natural enemies of the greater wax moth are the bees themselves. When the colony is strong, the bees will carry the moths from the hive and prevent any damage by the larvae. When combs are removed from the hive and stored, the best methods of controlling the insects are fumigating (using liquid or solid chemicals that form gases when exposed to the air) and then storing the combs properly.

In its larval stage, the moth damages combs and honey, and is responsible for large losses to beekeepers in the United States. Losses in the Southern States are considerably higher than in the North because of the longer season for both bee and moth activity.

Note: There is no danger of financial loss to the beekeeper from a project such as this, although the wax moths should be destroyed at the conclusion of the experiment.

The teacher should assume the responsibility for destroying the moths. The preferred method is to submerge the moths in chlorox for about 2 minutes. Alternate methods are refrigerating the insects or submerging them in hot water.

Scientists in the Entomology Research Division, Agricultural Research Service, are currently conducting research to control moths through heat treatment. They report that all stages of the wax moth failed to survive when subjected to a temperature of 120° F. with a relative humidity of 50 percent for a 24-hour period.

ACTIVITIES

The following activities are designed to introduce the child to the different changes some insects undergo on their way to becoming an adult.

Introduction

An insect undergoing complete metamorphosis goes through four distinct stages: egg, larva, pupa, and adult. Butterflies, moths, bees, beetles, and flies illustrate this type of metamorphosis. The larval form of insects may be known as a caterpillar (with a butterfly), maggot (fly), or grub (beetle). The larvae feed voraciously. Sometimes, during the pupal stage a special case is formed which may be called a cocoon (moth) or a chrysallis (butterfly).

All adult insects have six legs. Their bodies are divided into three parts: head, thorax, and abdomen. The head contains the brain, antennae (sensory organs), eyes, and mouth parts. The thorax holds the main muscles used in flying, walking, and swimming. The legs and wings are also attached to this middle section. The abdomen contains the digestive, reproductive, and excretory organs.

ACTIVITY I: Rearing The Greater Wax Moth

Materials: Wax moth eggs (about 1,000 eggs or 30 mg.)[1] [2]
Gallon jar with lid

Rearing medium:
1200 ml. or 5-3/4 cups (255 g. or 8.8 oz.) dry pablum (Mead-Johnson mixed cereal)

240 ml. or 1 cup (319 g. or 11 oz.) of sugar-glycerine-water mixture (500 ml. or 2 cups granulated sugar, 500 ml. or 2-1/4 cups glycerine, and 470 ml. or 2 cups water)

0.6 ml. of a vitamin mixture (Meads Dica-Vi-Sol) (The dropper is calibrated for 0.6 ml.)

20 mesh wire-screen discs

Large container to make a pablum mixture

Saucepan with cover or large Erlemeyer flask and cotton plug

Hot plate

Procedure:

1. Place granulated sugar, glycerine, and water in a jar. Swirl vigorously to mix.
2. Pour the mixture into a flask or saucepan and then cover.
3. Heat the mixture slowly, stirring often, until the sugar granules dissolve and the sugar solution clears (approximately 15 minutes). Allow to cool.
4. Cut a 20 mesh wire screen to fit the jar opening. Punch 3 or 4 small holes in the jar lid.
5. Place the wax moth eggs in the jar.
6. Add the vitamins to one cup, or 240 ml., of the sugar-glycerine-water solution. Stir it.
7. Pour pablum into a large container. Add the sugar-glycerine-water-vitamin solution. Mix them loosely but thoroughly. Try to prevent the pablum mixture from clumping.

[1] This project can be accomplished on a smaller scale by reducing the number of eggs, the size of the jar, and the amount of rearing medium proportionately. Example: Should you prefer a quart jar, use only one-fourth the amount of prepared medium and number of eggs suggested above.

[2] More than 1,000 eggs per jar results in either smaller larvae or the necessity of refeeding.

8. Place the pablum mixture on top of the eggs. Cover the jar opening with the 20 mesh wire disc and screw on the jar lid.
9. Incubate the culture at 93° F. (34° C.). If an incubator is not available, place the jar where a temperature near 93° F. can be maintained. Do not place the jar directly over a source of heat. In an incubator at 93° F., the complete metamorphosis from egg to adult will take approximately 4 to 6 weeks.

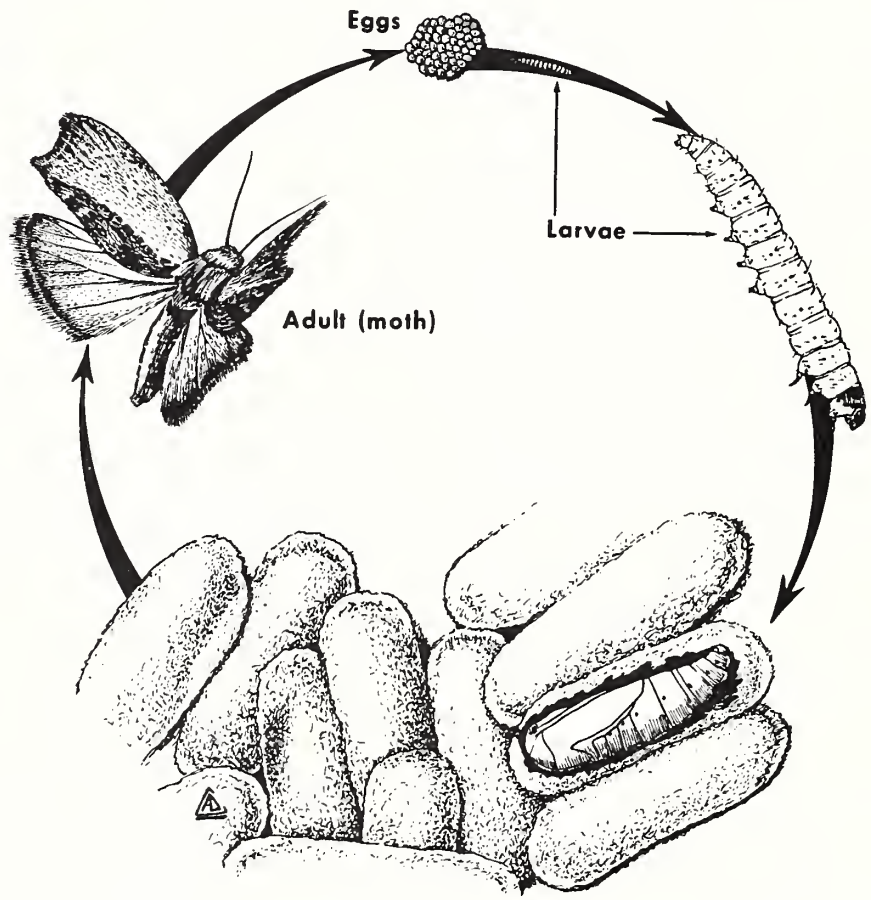
Description:

The greater wax moth goes through four different stages: as egg, larva, pupa, and adult.

The eggs are white and extremely small. If incubated at a temperature of 93° F., they will usually hatch in 3 to 4 days.

The larvae are very small and milky white or light tan. They are extremely active and crawl about rapidly. When disturbed, they can crawl backward almost as easily as forward. The children may observe silken threads and tunnels in the pablum mixture. These have been made by the larvae as they eat their way through the medium. As the larval stage progresses, the larvae change from light tan to a dark gray or brown in color, and movement becomes slower. The larvae wander about until they find a suitable place, usually outside the medium, where they spin their cocoons.

The cocoon consists of white silk, and when it has been completed, the insect enters the pupal stage. Now there is no visible movement, but inside the cocoon, the worm-like creature is changing into an adult moth. Development, from the beginning of the larval stage to the pupal stage, has taken about 30 days.



Ten days after the cocoon has been completed, the adult moth will emerge. Since the eggs first hatched, about 40 days have passed. The adult wax moth is about 3/4 of an inch long and has a wing spread of about 1-1/2 inches. It is usually brown, but sometimes can be gray. The adult is able to fly and often flutters its wings rapidly, but it usually prefers its legs as the primary means of movement. In approximately 2 to 4 days, the adult female may start to deposit eggs. The adult may live as long as three weeks. Thus, the children will be able to see all of the stages in the life cycle of an insect as it completes metamorphosis.

RELATED ACTIVITIES

Objective: To observe and describe the greater wax moth in each of its stages of development: as egg, larva, pupa, and adult.

Materials: Wax moth culture
Forceps
Magnifying glass
Microscope or microprojector (if available)
Paper towels or petri dish
(Note: These materials may be used in the following activities as well)

Activity A:

Objective: To observe and describe the greater wax moth in its egg stage.

Procedure: Before beginning the culture, let the children examine the eggs under a magnifying glass or under a microscope or microprojector. Encourage them to describe the objects in terms of color, size, shape, etc.

Suggested Questions:

1. Do these objects move?
2. What do you think they could be?

Follow Up: After the children have observed and described the wax moth eggs, have them draw a picture of this stage of development and then date it.

Activity B:

Objective: To observe and describe the greater wax moth in its larval stage.

Procedure: Examine the larvae of the wax moth carefully with a magnifying glass. Remove one or two larvae from the jar for closer examination.

Suggested Questions:

1. Repeat the questions from Activity A.
2. Have we added anything to the jar?
3. Where do you think the larvae came from?
4. Are there any other changes in the jar?
5. Is there movement? If there is, how do they move?

Follow Up: Draw another picture and date it. You may now introduce the term "larva".

Activity C:

Objective: To observe and describe the greater wax moth in the pupal stage.

Procedure: With forceps or with your hands, remove a few specimens from the jar. Place them in a petri dish or on a paper towel. Examine them carefully under a magnifying glass.

Suggested Questions:

1. Repeat the previous questions.
2. What happened to the larvae?

Follow Up: Draw a picture of the pupal stage and date it. Now introduce the terms "pupa" and "cocoon".

Activity D:

Objective: To observe and describe the greater wax moth in its adult form.

Procedure: Using a magnifying glass, examine the adult moths inside the jar.

Suggested Questions:

1. Repeat the questions from the preceeding activities.
2. What happened to the cocoon and pupa?

Follow Up: Draw a picture of the adult and date it. Introduce the terms "adult form," "insect," and "metamorphosis".

Activity E:

Objective: To observe and describe the eggs laid by the adult wax moth.

Procedure: Follow the same procedure and the same questions used in Activity A. Remove the eggs with a spoon. Note: To prevent the adults from escaping, refrigerate the jar for about 10 minutes. This will inactivate the adults and permit you to remove the eggs without the moths escaping.

Follow Up: Draw a picture and date it. Compare this picture with the one made from Activity A. Introduce the term "life cycle". Note: This is to illustrate to the children a complete life cycle from egg to adult to egg.

Activity F:

Objective: To observe differences in the growth rate due to temperature changes.

Procedure: Rear the moths at different temperatures. A temperature of 100° to 110° F. will speed up the whole life cycle. Between 50° and 70° F., the life cycle will slow down. Do not exceed the suggested extremes in temperature.

Suggested Questions:

What effect do cold (or hot) temperatures have on the rate of growth of the insect? Why?

Follow Up: Discuss other variables that could be tested: changes in diet (increase or decrease vitamins or other elements), changes in intensity or in light timing (the larvae and adults are very sensitive to light), etc. There are many other activities and tests that can be designed by the students themselves. Ask them for their suggestions.

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